

What is claimed is:

1. Tagged ammunition comprising:

- a projectile;
- a cartridge case;
- a propellant;
- a primer including primer reactants; and
- a taggant contained in the primer.

2. The tagged ammunition of claim 1 wherein the taggant is an ingredient in a mixture that includes the primer reactants.

3. The tagged ammunition of claim 1 wherein the taggant is positioned on the surface of the primer reactants.

4. The tagged ammunition of claim 3 further including a material of predetermined thickness positioned between the primer reactants and the taggant.

5. The tagged ammunition of claim 3 further including a material of predetermined thickness positioned between the propellant and the taggant.

6. The tagged ammunition of claim 4 further including a material of predetermined thickness positioned between the propellant and the taggant.

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7. Tagged ammunition comprising:

- a projectile;
- a cartridge case;
- a propellant;
- a primer having a primer case and primer reactants; and
- a taggant on the surface of the primer case.

8. The tagged ammunition of claim 7 further including a material of predetermined thickness positioned between the primer reactants and the taggant.

9. Tagged ammunition comprising:

- a projectile;
  - a cartridge case;
  - a propellant;
  - a primer;
  - a capsule made of a material capable of being destroyed during firing of the ammunition;
- and
- a taggant positioned within the capsule.

10. The tagged ammunition of claim 9 wherein the capsule is positioned within the cartridge case.

11. The tagged ammunition of claim 9 wherein the capsule is positioned in the primer.

12. Tagged ammunition comprising:

a projectile;

a cartridge case;

a propellant;

a primer;

a pellet made of a material capable of being destroyed during firing of the ammunition;

and

a taggant positioned within the pellet.

13. The tagged ammunition of claim 12 wherein the pellet is positioned within the cartridge case.

14. The tagged ammunition of claim 12 wherein the pellet is positioned in the primer.

#### Method of Tagging Ammunition

15. A method of tagging ammunition having a projectile, a primer, and a propellant comprising:

selecting a taggant; and

incorporating the taggant within the primer.

16. A method of tagging ammunition having a projectile, a propellant, and a primer including primer reactants comprising:

selecting a taggant; and

mixing the taggant with the primer reactants.

17. A method of tagging ammunition having a projectile, a propellant, and a primer including primer reactants comprising:

selecting a taggant; and

depositing the taggant on the surface of the primer reactants.

18. The method of claim 17 further including:

depositing a layer of material of predetermined thickness between the primer reactants and the taggant.

19. The method of claim 17 further including:

depositing a layer of material of predetermined thickness between the propellant and the taggant.

20. The method of claim 19 further including:

depositing a layer of material of predetermined thickness between the primer reactants and the taggant.

21. A method of tagging ammunition having a cartridge case, a projectile, a propellant, and a primer comprising:

selecting a taggant; and

depositing the taggant in a layer in the cartridge case.

22. The method of claim 21 further including:

depositing a layer of material of predetermined thickness between the cartridge case and the primer reactants.

23. A method of tagging ammunition having a cartridge case, a projectile, a propellant, and a primer including primer case and primer reactants comprising:

selecting a taggant; and

depositing the taggant in a layer in the primer case; and

depositing the primer reactants in the primer case so as to cover the taggant.

24. The method of claim 23 further including:

depositing a layer of material of predetermined thickness between the primer case and the primer reactants.

25. A method of tagging ammunition having a cartridge case, a projectile, a propellant, and a primer comprising:

selecting a taggant; and

depositing the taggant within a capsule made of a material easily destroyed during firing of the ammunition; and

depositing said capsule in the cartridge case.

26. A method of tagging ammunition having a cartridge case, a projectile, a propellant, and a primer comprising:

selecting a taggant; and

depositing the taggant within a capsule made of a material easily destroyed during firing of the ammunition; and

depositing said capsule in the primer.

27. A method of tagging ammunition having a cartridge case, a projectile, a propellant, and a primer comprising:

selecting a taggant; and

depositing the taggant within a pellet made of a material easily destroyed during firing of the ammunition; and

depositing said pellet in the cartridge case.

28. A method of tagging ammunition having a cartridge case, a projectile, a propellant, and a primer comprising:

selecting a taggant; and

depositing the taggant within a pellet made of a material easily destroyed during firing of the ammunition; and

depositing said pellet in the primer.

#### Fragmented Particulate Taggants

29. A particulate taggant for identifying a predetermined, encoded serial number comprising:

a first type of particle encoding a first portion of said serial number comprising:

a first code, representative of said first portion of the encoded serial number; and

a second code, identifying a particle to be one of the first type; and

a second type of particle encoding a second portion of said serial number comprising:

a third code, representative of a second portion of the encoded serial number; and  
a fourth code, identifying a particle to be one of the second type.

30. The taggant of claim 29 further including:

a third type of particle encoding a third portion of said serial number comprising:  
a fifth code, representative of a third portion of the encoded serial number; and  
a sixth code, identifying a particle to be one of the third type.

31. The taggant of claim 29 further including:

multiple additional types of particles, each additional type of particle encoding one additional portion of said serial number, and each additional type of particle comprising:  
a code, representative of said additional portion of the encoded serial number; and  
a code, identifying a particle to be of the type encoding said additional portion of the encoded serial number.

#### Methods of Tagging Using Fragmented Particulate Taggants

32. A method of tagging comprising:

selecting a serial number;  
selecting a first portion of said serial number;  
selecting a second portion of said serial number;  
providing a plurality of first type of taggant particles;  
each of said first type of taggant particles containing a code indicative of the value  
of the first portion of said serial number; and

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each of said first type of taggant particles containing a code identifying the particle to be one of the first type; and  
providing a plurality of second type of taggant particles;

each of said second type of taggant particles containing a code indicative of the value of the second portion of said serial number; and

each of said second type of taggant particles containing a code identifying the particle to be one of the second type.

33. The method of claim 32 further comprising:

providing a plurality of a third type of taggant particles;

each of said third type of taggant particles containing a code indicative of the value of a third portion of said serial number; and

each of said third type of taggant particles containing a code identifying the particle to be one of the third type.

34. The method of claim 32 further comprising:

providing multiple additional types of taggant particles;

each particle of each additional type of particles containing a code indicative of the value of a predesignated additional portion of said serial number; and

each particle of each additional type of particles containing a code identifying the particle to be of the type encoding said predesignated additional portion of the encoded serial number.

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### Methods of Encoding Distributed Taggants

35. A method of encoding chemical taggants using multiple pairs of chemicals to represent the bits of a binary serial number wherein the presence of one chemical of each pair represents a first predetermined bit value and the presence of the other chemical of each pair represents a second predetermined bit value.

36. The method of claim 35 where one of the predetermined bit values is 0 and the other predetermined bit value is 1.

37. A method of encoding chemical taggants comprising:

identifying a group of  $M \times N$  distinct chemical taggants where  $M$  and  $N$  are integers; and

dividing said chemical taggants into  $M$  groups of  $N$  chemicals each; and

assigning one taggant chemical from each of the  $M$  groups to correspond to each integer from 0 to  $N-1$  inclusive; and

isolating the substance to be tagged and assigning to it an  $M$ -digit, base- $N$  serial number; and

adding to the substance to be tagged a quantity of each of the  $M$  chemicals corresponding to the values of the  $M$  digits in the assigned serial number.

38. The method of claim 37 where at least one of the taggant chemicals is isotopically substituted.

39. A method of encoding isotopic taggants using multiple pairs of isotopes to represent the bits of a binary serial number wherein the presence of one isotope of each pair represents a first

predetermined bit value and the presence of the other isotope of each pair represents a second predetermined bit value.

40. The method of claim 39 where one of the predetermined bit values is 0 and the other predetermined bit value is 1.

41. A method of encoding isotopic taggants comprising:

identifying a group of  $M \times N$  distinct isotopic taggants where  $M$  and  $N$  are integers; and

dividing said isotopic taggants into  $M$  groups of  $N$  isotopes each; and

assigning one taggant isotope from each of the  $M$  groups to correspond to each integer from 0 to  $N-1$  inclusive; and

isolating the substance to be tagged and assigning to it an  $M$ -digit, base- $N$  serial number;

and

adding to the substance to be tagged a quantity of each of the  $M$  isotopes corresponding to the values of the  $M$  digits in the assigned serial number.

#### Base- $N$ Taggants

42. A binary taggant comprising:

at least a first chemical pair comprising:

a first chemical of the first chemical pair capable of functioning as a taggant and representative of the first of two binary values; and

a second chemical of the first chemical pair capable of functioning as a taggant and representative of the second of the two binary values.

43. The binary taggant of claim 42 further comprising:

a second chemical pair comprising:

a first chemical of the second chemical pair capable of functioning as a taggant and representative of the first of two binary values; and

a second chemical of the second chemical pair capable of functioning as a taggant and representative of the second of the two binary values.

44. The binary taggant of claim 42 further comprising:

at least two additional chemical pairs each of said pairs comprising:

a first chemical of each additional chemical pair capable of functioning as a taggant and representative of the first of two binary values; and

a second chemical of each additional chemical pair capable of functioning as a taggant and representative of the second of the two binary values.

45. A binary taggant comprising:

at least a first isotope pair comprising:

a first isotope of the first isotope pair capable of functioning as a taggant and representative of the first of two binary values; and

a second isotope of the first isotope pair capable of functioning as a taggant and representative of the second of the two binary values.

46. The binary taggant of claim 45 further comprising:

a second isotope pair comprising:

a first isotope of the second isotope pair capable of functioning as a taggant and representative of the first of two binary values; and

a second isotope of the second isotope pair capable of functioning as a taggant and representative of the second of the two binary values.

47. The binary taggant of claim 45 further comprising:

at least two additional isotope pairs each of said pairs comprising:

a first isotope of each additional isotope pair capable of functioning as a taggant and representative of the first of two binary values; and

a second isotope of each additional isotope pair capable of functioning as a taggant and representative of the second of the two binary values.

48. An encoded taggant system capable of representing any M-digit, base-N serial number where M and N are integers, comprising:

M x N distinct chemicals each capable of functioning as a taggant;

said M x N distinct chemicals grouped into M groups of N distinct chemicals in each of the M groups; and

each of the N distinct chemical in each of the M groups corresponding to one integer from 0 to N-1 inclusive,

whereby a quantity of the distinct chemicals corresponding to the values of a predetermined, M-digit, base-N serial number may be selected and added to a substance assigned to the predetermined serial number.

49. The taggant system of claim 48 wherein at least one of the taggant chemicals is isotopically substituted.

#### Methods of Ensuring Authentication For Taggants

50. A method of ensuring the authenticity of an identification taggant comprising:

selecting a first taggant representative of identification information;

selecting a second taggant representative of an authentication code; and

combining the first and second taggants to form an authenticated taggant.

51. The method of claim 50 wherein the first taggant is selected from the group consisting essentially of particulate, chemical, or isotopic taggants and

the second taggant is selected from the group consisting essentially of another one of either particulate, chemical or isotopic taggants.

52. The method of claim 50 wherein the first taggant is a fragmented particulate taggant, and the second taggant is an isotopic taggant.

53. The method of claim 52 where the said identification information is selected from one or more of the identity of the manufacturer, type of ammunition, date of manufacture, and/or place of manufacture.

#### Authenticated Taggants

54. A taggant composition comprising:

- a first taggant encoding identifying information; and
- a second taggant encoding an authentication code.

55. The taggant composition of claim 54 where the first taggant is selected from the group consisting essentially of particulate, chemical, or isotopic taggants, and

the second taggant is selected from the group consisting essentially of another one of either particulate, chemical or isotopic taggants.

56. A taggant composition comprising:

- a particulate taggant; and
- a distributed taggant.

57. The taggant composition of claim 56 wherein the distributed taggant is:

- a distributed chemical taggant.

58. The taggant composition of claim 56 wherein the distributed taggant is:

- a distributed isotopic taggant.

#### Labeled Taggant System and Method

59. A method of tagging ammunition having a projectile, a cartridge, and a primer comprising:

- printing a label on the primer such that it is readable after the ammunition is fully assembled; and

selecting a taggant; and

depositing the taggant in the primer.

60. Tagged ammunition comprising:

a projectile;

a cartridge case;

a primer;

a taggant positioned within the primer; and

a label on the primer visible when the ammunition is fully assembled.

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